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METHODS FOR LINING OR COATING INSTALLED METAL PIPING - A LITERATURE SURVEY

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METHODS FOR LINING OR COATING INSTALLED METAL PIPING - A LITERATURE SURVEY

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ABSTRACT

Two methods are discussed, either of which can be used for the repair of in-place piping which is corroded internally: (1) Cleaning followed by coating with an organic material, and (2) Installation of a plastic liner. Field experience has shown that both methods are effective.

INTRODUCTION

When the interior surface of a metal piping system becomes corroded, the usual maintenance procedure calls for replacement of this system by one which is more corrosion resistant. However, in certain cases, replacement of the existing system is considered impractical because of its physical location or because of the economics involved. Therefore, the Bureau of Yards and Docks requested the Laboratory to investigate techniques for coating the interior of installed metal piping.[1] A literature survey was conducted and two methods, which are effective in field use, were found.

METHODS

Internal Cleaning and Coating[2,3,4,5]

Both cleaning and coating operations are accomplished by forcing specially designed plugs through the pipe. These plugs carry along mechanical devices or chemicals for cleaning and the finish coatings. In some cases two plugs are used and the cleaner or coating moves through the pipe in the space between the plugs.

Cleaning. Cleaning is accomplished in several steps and consists of both mechanical and chemical methods. If the pipe has been used for an organic material, such as oil, it is generally first flushed with a solvent to remove the organic residue. Care must be exercised to avoid fire or explosion. Then, a typical cleaning procedure would proceed as follows:

1. Degreasing (the solvent washing leaves an oil film) with aqueous detergent solutions followed by water rinsing.

2. Acid rinsing with hydrochloric acid solution with the acid concentration and contact time based on previous experience.

3. Alkaline rinsing to neutralize the residual acid.

4. Rinsing with water.

5. Drying with forced air, aspirated air, or by forcing a plug with an absorbent material through the pipe.

6. Mechanical scrubbing by forcing plugs containing brushes through the pipe.

7. Giving "tooth" to the surface by rinsing with a special solution containing phosphoric acid.

8. Rinsing to remove the residues remaining after Step 7.

9. Drying.

10. Pressure testing the piping.

11. Flushing with a solvent compatible with the coating.

It should be noted that each of the above steps will require more than one pass of the material through the pipe, and that procedures and solutions used may have to be modified to fit the particular situation.

Coating. Coating is generally accomplished by the two-plug method. The coating material is run into the pipe between the two plugs. Air pressure is applied from either end of the pipe with that on the lead plug slightly less than the rear plug. Thus, the two plugs, with the coating material sandwiched between them, move through the pipe by differential pressure. Because of this, the coating material is always under positive pressure and is forced into pits and crevices in the wall. When the coating train has reached the end of the pipe, the excess coating is removed and the interior surface is dried with forced or aspirated air. Slow drying is desirable because this tends to lessen the number of pinholes. Both primer and finish coats have been applied by this method.

Coating Materials. Two coating systems have been used with very good results in various industrial applications, especially in oil field pipelines and in chemical processing plants: (1) a high solids vinyl, and (2) an amine cured epoxy. The final choice as to what coating to use and its possible service life will depend on the type of liquid to be transported and its temperature.

General Requirements. Most of the repair of installed piping has been done by the internal cleaning and coating method. Where successful repairs have been made, there has always been a thorough inspection of the pipe before the job has begun and a thorough inspection after each cleaning and coating step. The coating should be applied and dried according to the manufacturer's instructions and should not be applied when the atmospheric temperature is below 40 F or when the dew point approaches the atmospheric temperature.

Two topcoats of at least 5 mils dry film thickness each are the minimum for satisfactory service.

Installation of a Plastic Liner[6,7]

A device has been demonstrated which can unroll a spooled tubular plastic liner inside a pipe line by means of low pressure nitrogen gas.[6] It is expected that this device will be commercially available soon.

At the Hanford Atomic Products Operation, Richland, Washington, a steam pipe imbedded in concrete failed because of stress-corrosion cracking. This pipe was repaired in place by pulling a polytetrafluoroethylene liner through it with specially designed equipment. An electrically heated flaring tool was used to form an end gasket so that a flanged connection could be made.[7]

ECONOMICS

Based on a hypothetical 4-inch gravity line with a required life of 14 years, the maintenance cost per foot per year for plastic coated steel pipe is approximately one-third that for unprotected steel pipe; for longer life periods, the cost would be about one-half that for unprotected steel pipe;[8] however, prices will vary with contractors and jobs.

No cost data are available on the installation of plastic liners.

FINDINGS

Two methods can be used to repair the corroded internal surfaces of installed piping.

1. One method consists of cleaning the interior surface of the pipe, followed by the application of at least two coats of a plastic coating to give a total minimum dry film thickness of 10 mils.

2. The other method consists of placing a tubular plastic liner inside the pipe.

RECOMMENDATIONS

1. It is recommended that either of the two above methods be used when it is necessary to repair installed piping which has corroded internal surfaces. The choice of method and materials will depend on the particular job and on the required use for the piping system.

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